

***Erpobdella lahontana* (Annelida: Hirudinea: Arhynchobdellida:
Erpobdellidae), a new species of freshwater leech from
North America**

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Abstract.—new species of a leech, *Erpobdella lahontana*, is described from the Lahontan Basin in California and Nevada of the western United States. This species has four pairs of eyes, the preatrial loops of male paired ducts extend to ganglion XI, and the male and female gonopores are located in furrows of the annuli, separated by five annuli.

The zoological history of the Great Basin of the western United States has resulted in an area of high endemism of fishes (Hubbs & Miller 1948) and hydrobiid snails (Hershler 1998). However, amphibians have not morphologically evolved into endemics and may be the result of very recent immigration to the region (Hovingh 1997).

A general survey of the Great Basin and adjacent regions of the western United States was undertaken to determine if leeches had drainage specific distributions. Over 2300 aquatic sites were surveyed in the Great Basin including some 600 sites within the Lahontan Basin. Leeches show an entirely different pattern than fishes, hydrobiid snails, and amphibians with respect to basin specific distribution without morphological evolution, suggesting evolutionary stasis and an inhabitant of the Great Basin since its geological formation in the Miocene (Hovingh, unpublished data). Within this study, an erpobdellid leech was identified with the gonopores separated by five annuli. This leech was found in two separate drainages of the Honey Lake Subbasin (Eagle Lake and one other location out of the 2300 sites in the survey) in the Lahontan Basin of northeastern California. This paper describes this new leech species

and is the first endemic species of leech to be found in the Great Basin.

Materials and Methods

Collection methods consisted of examining the underside of substrates such as rocks, logs, and anthropogenic debris in the periphery of aquatic systems (i.e., springs, streams, and lakes) up to 100 cm deep. Leeches were relaxed with dilute ethanol, wiped clean of mucous, fixed in 10% formalin overnight, and preserved in 70% ethanol. Histological examination of serial sections of the clitellum region, after staining with hematoxylin and eosin, was used for detailed morphological analysis of the genital atrium, cornua, and preatrial loops of the ejaculatory ducts. A model of the genital atrium, cornua, and preatrial loops was constructed from photographs taken of the serial sections.

Systematics

Family Erpobdellidae Blanchard, 1894
Genus *Erpobdella* Blainville, 1918
Erpobdella lahontana, new species

Type material.—Holotype, United States National Museum (USNM 186409) and 8

paratypes (USNM 186410), deposited in the National Museum of Natural History, Division of Worms, Smithsonian Institution, Washington, D.C., collected 15 Sep 1997, same locality.

Type locality.—Eagle Lake, Lassen County, California; latitude 40°33.5'N and longitude 120°48.8'W (selected by the abundance of leeches at this locality and public access to the lake).

Diagnosis.—Dorsal surface dark gray, heavily mottled with light gray spots; white or yellow irregular minute, transverse rows of papillae on the dorsal side of every annulus with some living specimens having prominent papillae on both dorsal and ventral sides; dorsum with a light black mid-dorsal stripe or plain; five-annulate, each annulus of approximately equal size; four pairs of eyes: first pair of labial eyes large, second pair of smaller labial eyes behind first pair; buccal eyes two pairs, small; male and female gonopores separated by five annuli, located in furrows of segments XII and XIII and male gonopore large, raised, and especially glandular (Fig. 1); atrium with cornua (horns), with sperm ducts forming paired preatrial loops extending anteriorly to ganglion XI (Figs. 2, 3). Preatrial loops angle laterally and anteriorly from cornua. Cornua and preatrial loops dip ventrally to join each other. Ovisacs extend posteriorly to ganglion XV. Five annuli separate the segmental ganglia.

Description of Holotype

External anatomy.—(based on holotype, USNM 186409): Body elongate, flattened, sides of body narrowing along most of length to pointed head (length 30 mm, maximum width 3 mm); body wall uniformly smoke-gray, dorsal surface darker gray than ventral surface, dorsal surface with a faint middorsal dark line, no black pigmentation; dorsal surface dark gray, heavily mottled with light gray spots; somites five-annulate; white irregular minute, transverse rows of papillae on every annulus; clitellum con-

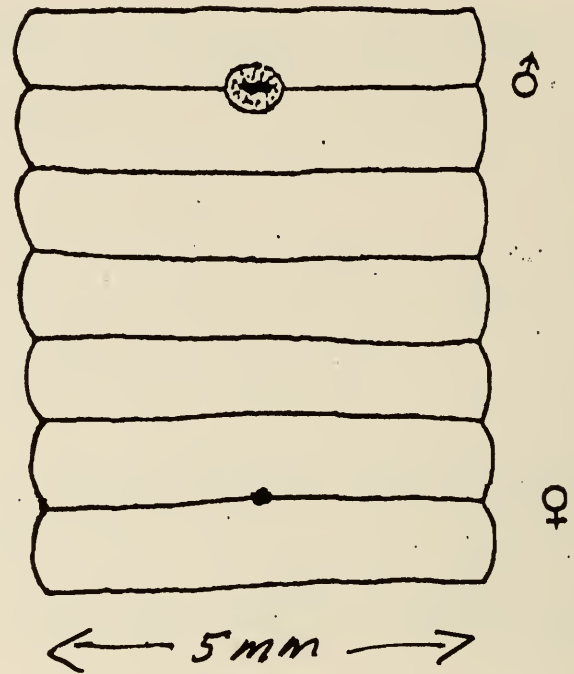


Fig. 1. *Erpobdella lahontana*. Ventral view, male and female gonopores (holotype).

spicuous, 15 annulate; nephridiopores on b_2 annulus of XI and XII (other nephridiopores not determined); mouth small (width of oral sucker 1 mm); eyes four pair, one large labial pair, second pair of small labial eyes behind first pair and two smaller buccal pairs on fourth annulus (further posterior); anus surrounded by papillae, located dorsally at the base of the caudal sucker; caudal sucker small (width 2 mm), less than one-half maximum body width; male gonopore large, raised, cylindrical and glandular, (Fig. 1) located in furrow of the clitellum region between annuli XII b_1 and XII b_2 ; distance from mouth to male gonopore, 14 mm; female gonopore inconspicuous, located in furrow between annuli XIII b_1 and XIII b_2 .

Internal anatomy.—(based on dissection of paratypes): Atrium wider than long; atrial horns projecting anteriorly; preatrial loops of vas deferens extending to ganglion XI; ovisacs extend from segments XIII to XV.

Additional observations of paratypes (USNM 186410).—External anatomy. Paratypes resemble the holotype with the following additional observations: length

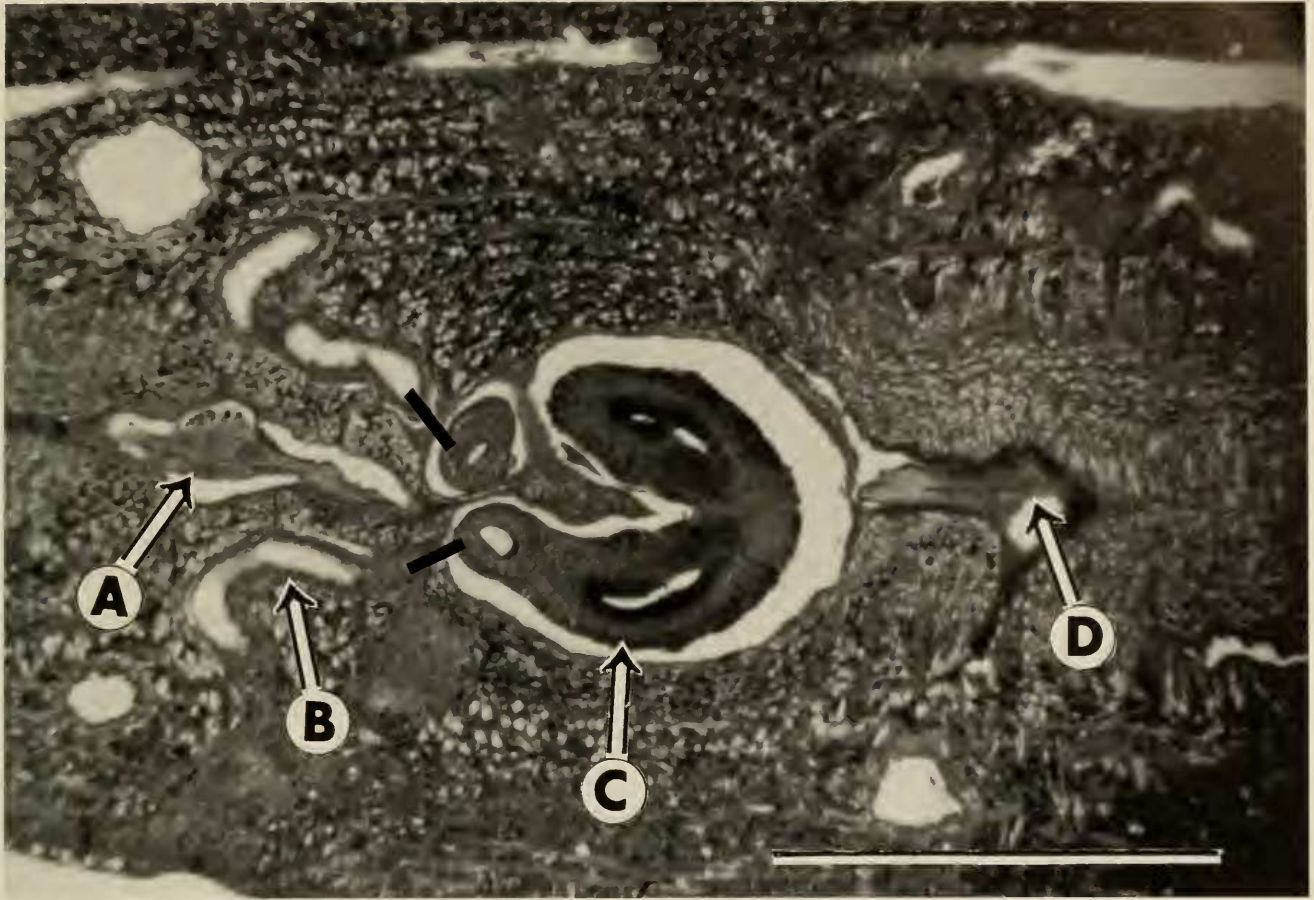


Fig. 2. Photograph of horizontal (parallel to dorsal and ventral surfaces) section of the region between Ganglion XI (denoted A) and Ganglion XII (denoted D) showing the preatrial loops (denoted B) and the genital atrium (denoted C) with cornua. The angle in which the preatrial loops join the cornua is indicated by short bars: 30° for the left side and 45° for the right side as viewed from the dorsum. Note that the right cornua displays an oval cross-section representing the section that has turned ventrally. Long bar = 1 mm.

(42–55 mm) and width (3.5–5 mm) of some individuals varies from the holotype; clitellum is inconspicuous in some individuals; female gonopore difficult to locate in some individuals; anus small to large in some paratypes.

Remarks.—The eyes in four pairs are arranged in two transverse rows; mouth with muscular ridges but no jaws; body segments (somites) five-annulate with all annuli of approximately equal in width. The structure of the reproductive system shows that this species belongs to the genus *Eropobdella* Blainville, 1918, with preatrial loops of the male paired ducts and testes in small, numerous bunched sacs.

Distribution, habitat, and ecology.—*Eropobdella lahontana* is found in two subbasins of the western Lahontan Basin (Fig. 4): Eagle Lake and Grasshopper Valley in Las-

sen County, California. The Pleistocene precursor of Eagle Lake and Grasshopper Valley (Madeline Plains) drained into Honey Lake Subbasin, the latter being an arm of Pleistocene Lake Lahontan. The new species was found in Buck Bay in the north part of Eagle Lake and along the south shore of Eagle Lake. In Eagle Lake, the leech was often found on vesicular basaltic rocks. When removing the leech, the posterior sucker would remain on the rocks. This occurred with five leeches after which sampling was from smoother artificial substrate. The leech was found in the outflow of springs in Grasshopper Valley. Elevations varied from 1555 to 1625 m above mean sea level (msl). Eagle Lake and, to a lesser extent, the Grasshopper Valley were associated with ponderosa pine (*Pinus ponderosa*) forest and both belong to the Mo-

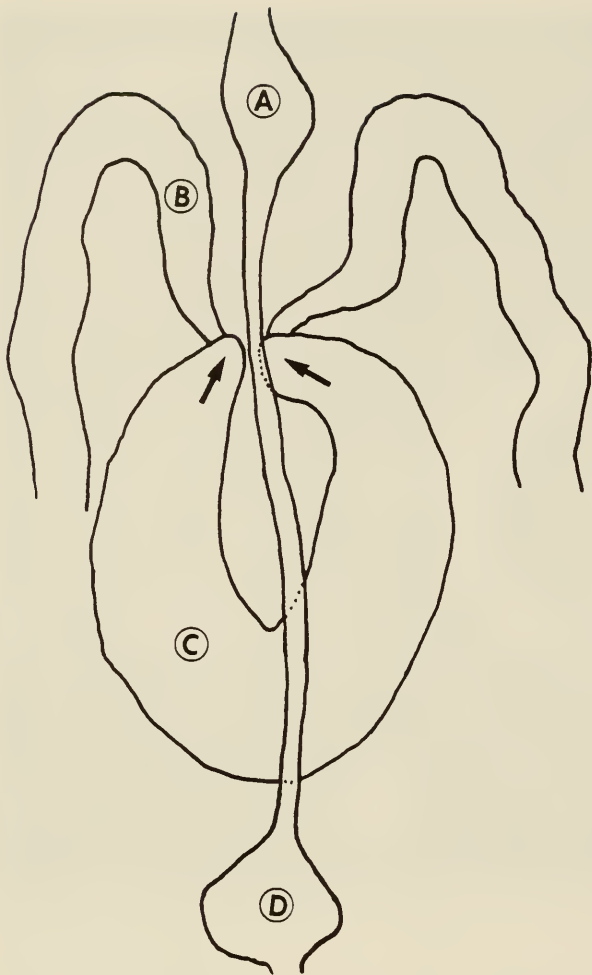


Fig. 3. Dorsal view of male genital atrium and ejaculatory ducts. Legend same as in Figure 2. Drawing made from a model constructed from photographs of serial sections of this region. The arrows denote where the cornua (paired horns) and the preatrial loops both turn ventrally before they are joined. The right cornua also makes a turn to the center.

doc Plateau geomorphic province, a region of numerous basalt-andesite flows which isolated these two basins from Honey Lake (Gester 1962). Eagle Lake (12,150 ha) has three subbasins of which two (north and central) basins do not stratify due to their shallow nature and strong winds. Conductivity of Eagle Lake is near 800 μ Mhos, probably as a result of the fact that 40% of Eagle Lake's inflow is derived from ground water (Huntsinger & Maslin 1976). Eagle Lake contains five species and Madeline Plains contains one species of native fish. The ecology of Eagle Lake is further described by Huntsinger & Maslin (1976). Two other locations in the Lahontan Basin (Winnemucca and Granite Springs Subba-

sins, east of Pyramid Lake, Nevada) contained leeches in which the gonopores were separated by five annuli, and these populations are still under investigation.

Associated leech species.—*Erpobdella lahontana* was associated with the leeches *Erpobdella punctata* (Leidy, 1870), *Helobdella stagnalis* (Linnaeus, 1758), and *Hae-mopis marmorata* (Say, 1824). In Grasshopper Valley, *H. marmorata* was associated with *E. lahontana*. Eagle Lake specimens at the National Museum of Natural History, Worm Division, include: *E. punctata* (USNM 42502, USNM 60061, USNM 60062), *Glossiphonia complanata* (USNM 2572), *Placobdella ornata* (USNM 60055), *Theromyzon trizonare* (USNM 42500), and *H. marmorata* (USNM 42570). The leech specimen (USNM 42571) was classified as *Dina fervida*, but this specimen is most likely *E. lahontana*. The gonopore separation was not unresolved, but the pigmentation and number of eyes suggested this species.

Variations.—All Eagle Lake specimens (22) were identical with respect to eyes and the number of annuli between gonopores. Some specimens contained dark annuli in which the papillae became conspicuous with an even darker dorsal strip, and this varied to uniform light color with invisible papillae and with no dorsal strip. Sizes of leech specimens were up to 55 mm long and 3.5 mm wide.

Similar species.—*Erpobdella lahontana* is distinguished from *E. dubia* (Moore & Meyer, 1951), *E. parva* (Moore, 1912), and *E. punctata* (Leidy, 1870) by the five annuli separating the gonopores. *Erpobdella dubia* (dorsum greenish, heavily mottled, usually with a variable dark mid-dorsal stripe; gonopores separated by 3.5–4 annuli) and *E. parva* (dorsum unpigmented or color uniformly smokey gray; gonopores separated by 2.5–3.5 annuli) have not been observed in the Great Basin collections with the gonopores separated by five annuli. If the gonopores are not distinguishable, the pigmentation patterns of *E. lahontana* could lead

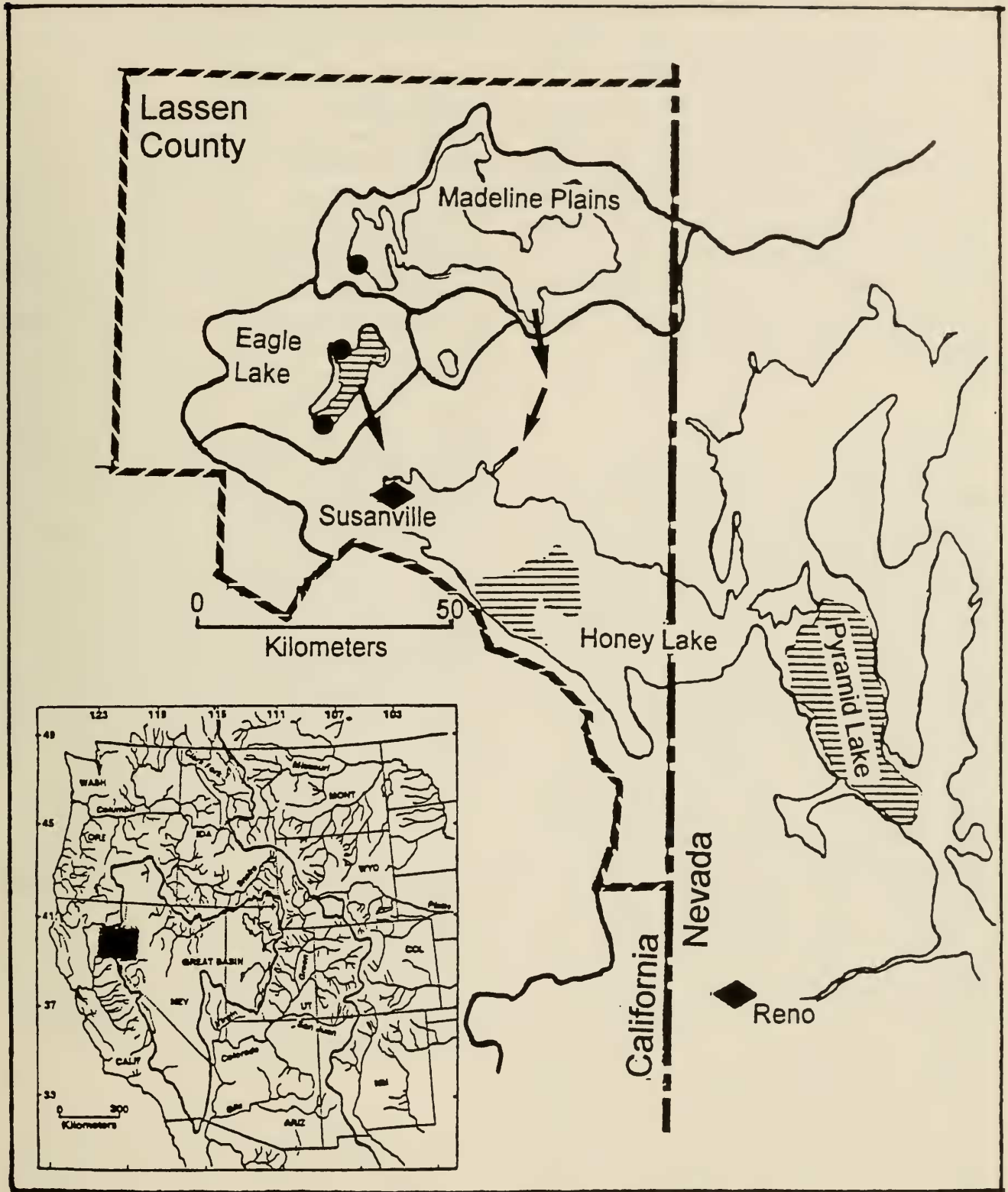


Fig. 4. Map of the western Lahontan Basin in California and Nevada. Lassen County is enclosed and the communities of Susanville, California and Reno, Nevada are designated by diamonds. The heavy solid line denotes the Lahontan Basin with arrows showing Pleistocene drainages from Eagle Lake and Madeline Plains Subbasins. The light solid line shows the extent of Pleistocene lakes with the patterned horizontal lines showing the present Eagle, Honey, and Pyramid Lakes. The three solid circles show location of *Erpobdella lahontana* in Eagle Lake and in Grasshopper Valley of the Madeline Plains Subbasin. Inset shows the locations in relation to the Great Basin and the western United States. Map derived from Snyder et al. (1964).

to some confusion with *E. dubia* and *E. parva*, neither of which has been found in the Lahontan Basin. *E. punctata* has been found in the Great Basin, but this species can be distinguished easily from *E. lahontana* by having only two annuli separating the male and female gonopores, and having three pairs of eyes. Taxonomic discussion and keys to the family Erpobdellidae and these North American species can be found in Sawyer (1972, 1986b), Klemm (1985, 1990, 1995) and Davies (1991).

Discussion

Similar species, *Erpobdella dubia* and *E. parva*, to the new species, *E. lahontana*, have been historically classified within the genus *Dina* (Soos 1963, 1966, 1968; Sawyer 1972, Klemm 1985, Davies 1991). The genus (or subgenus) *Dina* is identified by the fact that every fifth annulus (b_6) of a somite is distinctly wider or more broad than the other four annuli and is subdivided by a faint transverse furrow (Lukin 1976, Mann 1982, Sawyer 1986a, 1986b; Davies 1991, Neseemann 1995, Neubert & Neseemann 1995). Also, the genus *Dina* is reported from only the southern, western, and central areas of the Palaearctic region (Lukin 1976, Sawyer 1986b). Therefore, Sawyer (1986a, 1986b) revised the genus *Erpobdella* to include the two species of *Dina* from the Nearctic region, including North America, based on the equal width of all the body annuli and distribution of *E. dubia* and *E. parva*. It was concluded that the genus *Dina* was not found in North America. This was later confirmed by Klemm (1990, 1995). The North America (Nearctic region) genera *Nephelopsis*, *Mooreobdella*, and the Palearctic region genus *Dina* were grouped together by the feature that, of any five annuli of the body somites, there is one annulus that is distinctly wider than the other four annuli and usually subdivided by a faint transverse furrow (Mann 1962, Lukin 1976, Sawyer 1986b, Davies 1991). This anatomical feature was not seen in Great

Basin species of Erpobdellidae. All the species of erpobdellids in North America have annuli of similar width.

Etymology.—Louis Armand de Lom d'Arce, Baron de Lahontan was a 17th century French explorer of the upper Mississippi River basin who suggested that the western continental flows drained into a saline lake and then into the ocean. Although Baron de Lahontan may never have entered the western drainages or the Great Basin, the large western basin, Lahontan Basin, within the Great Basin was named after the Baron (Cline 1963). The leech is, thus, named after the basin in which it is found.

The anatomical tradeoff in erpobdellid leeches having preatrial loops and having the gonopores separated by more annuli is that the preatrial loops and the cornua may become shorter. An evolutionary compensation would be for the cornua and the preatrial loop to form contortions. This may be what is happening in *Erpobdella lahontana* with the cornua and the preatrial loops both taking a ventral dip to their junction.

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